

# Field Observations of an Expeditionary Strike Group: A Prerequisite to Model-driven Experimentation of Adaptive C2 Processes

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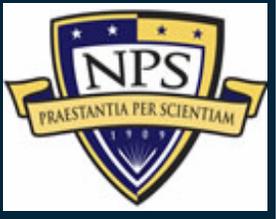
<sup>1</sup> Naval Postgraduate School

<sup>2</sup> Aptima, Inc.

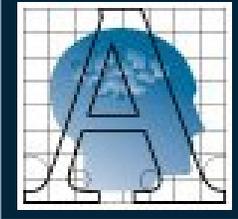
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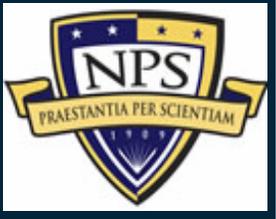


# Acknowledgements

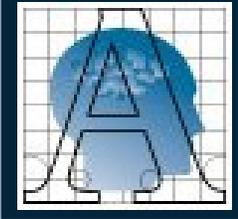


The authors would like to thank:

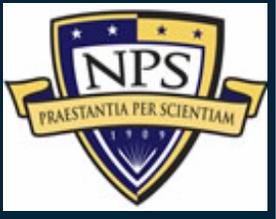
- Dr. Gerald Malecki
  - Office of Naval Research
- Ron Moore, Gene Averett, Jean Catanzaro
  - Pacific Science & Engineering
- Georgiy Levchuk, Yuri Levchuk, Elliot Entin
  - Aptima, Inc
- The men and women of the Expeditionary Strike Group, Amphibious Squadron, and Marine Expeditionary Unit who donated their time and expertise



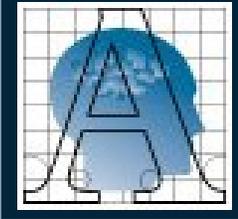
# Goals of the Project



- A2C2: 10+ years of research in C2
- Abstracted military organizations in our laboratory designs
- Presented with a real organization – the Expeditionary Strike Group – having real organizational issues
- How can we...
  - Identify the organizational challenges
  - Pull from our previous research to present ideas
  - Anchor future research based on observations

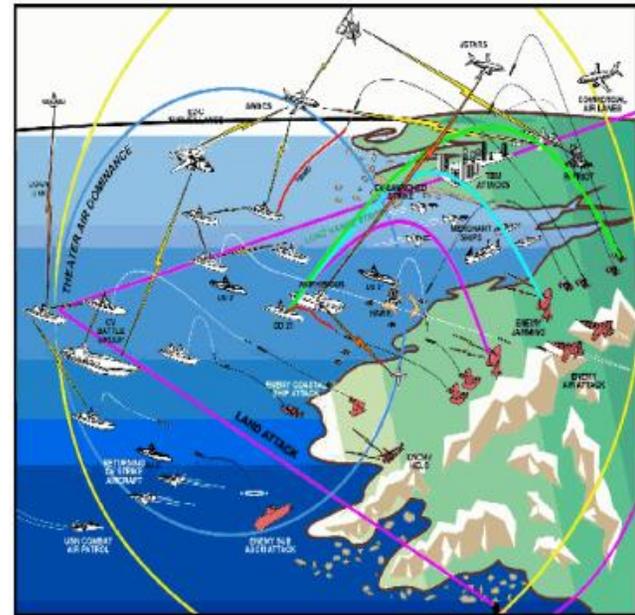


# The A2C2 Project



## The General Problem:

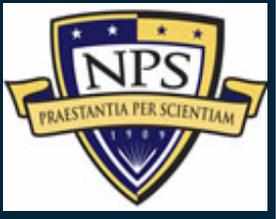
→ How would you design a command team organization for this mission?



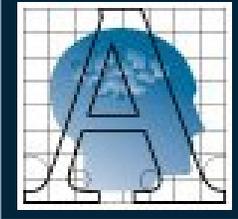
→ How would you derive human requirements for the organization?

→ How would you evaluate its performance for this mission?

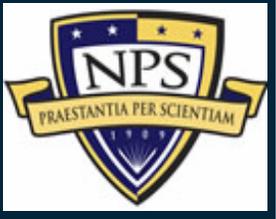
→ How would you design adaptability into this organization?



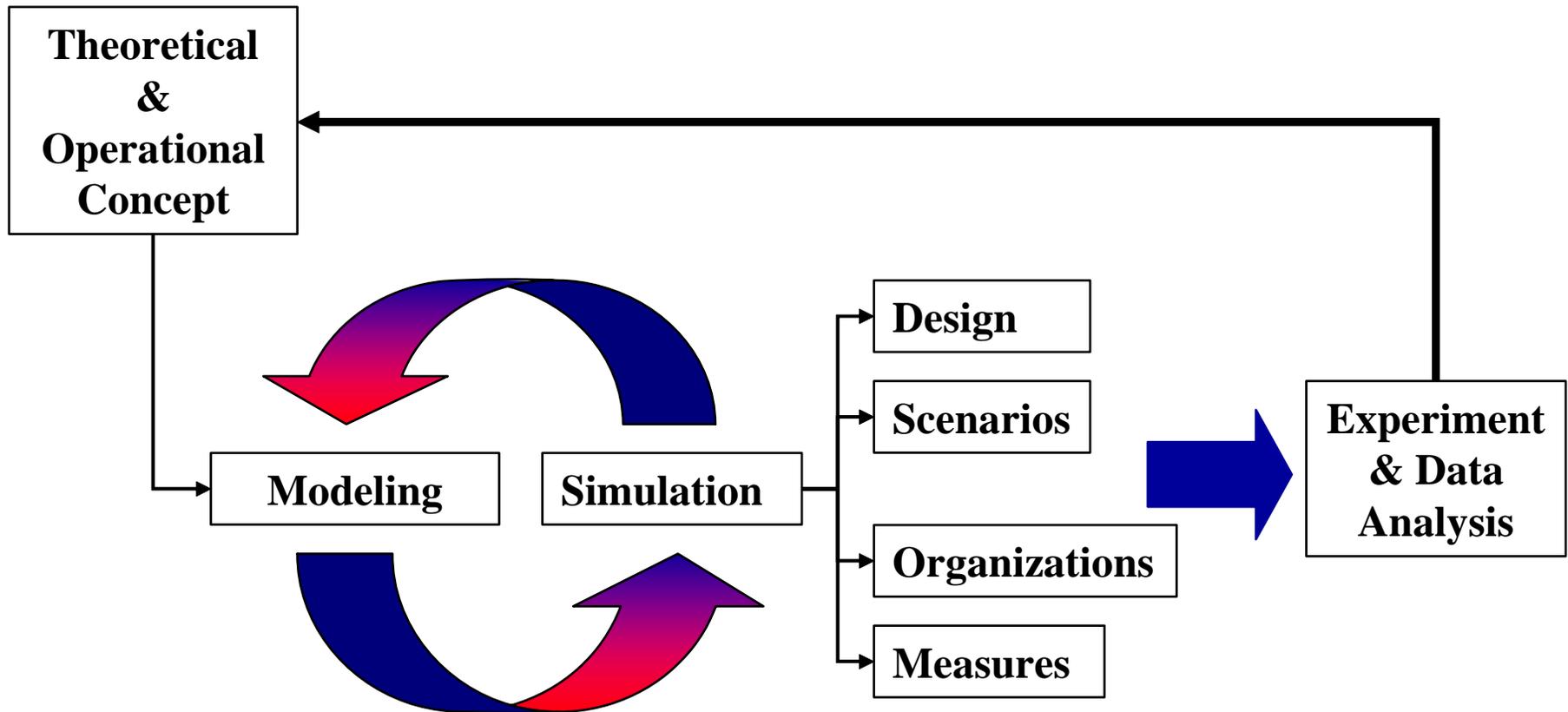
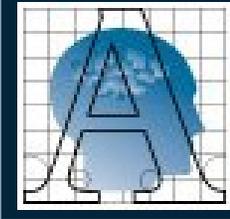
# The A2C2 Project

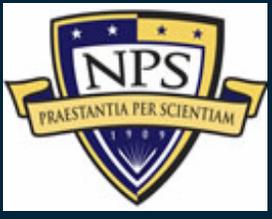


- Research undertaken by government, academic, and industry groups
  - **Aptima, Inc.** (main coordinator)
  - **Naval Postgraduate School**
  - **University of Connecticut**
  - George Mason, Michigan State, Carnegie Mellon Universities
  - Naval War College
- Iterative model-experiment-model approach
- Issues addressed in recent years
  - Organizational congruence
  - Structural adaptation to change
  - Optimization of resource allocation
  - Coordination among decision makers
  - Implications of Intelligence/Information commander

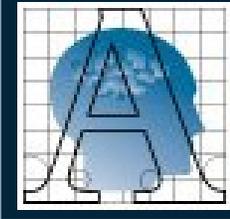


# Model-Based Experimentation Paradigm

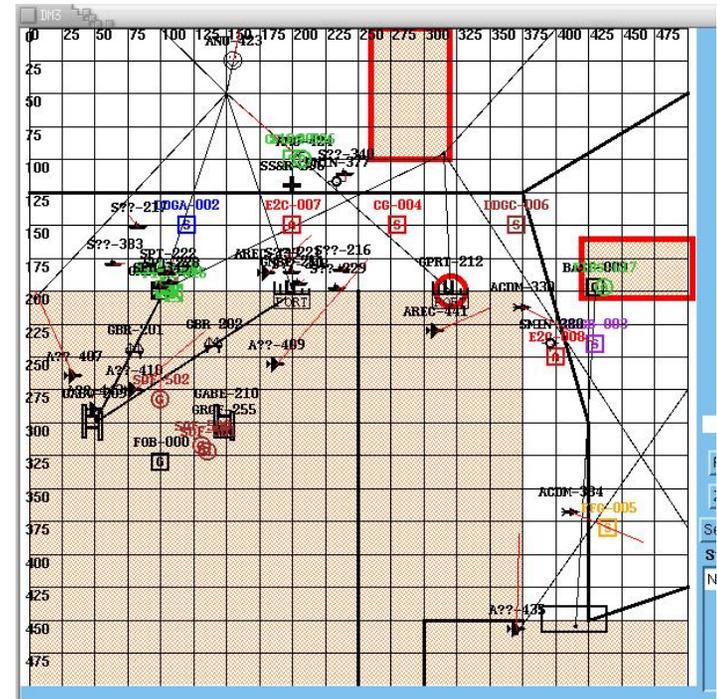


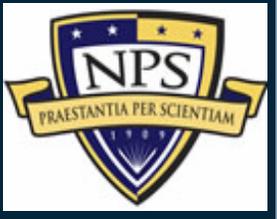


# Distributed Dynamic Decisionmaking Environment (DDD)

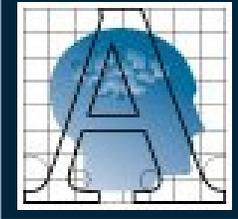


- Captures essential elements of C2
- Experimental variables
  - Team structure including roles and responsibilities
  - Access to information
  - Control of resources
  - Mission parameters
- Provides substantial degree of experimental control
- Designed to capture measures
  - Performance and process measures

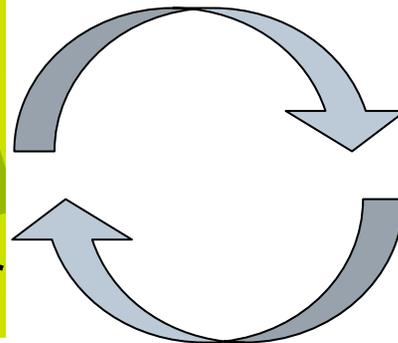




# The Lab-to-Sea Bridge

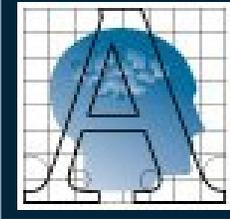


- What can we take from previous research and apply it to an operational organization?
- What can we take from a case study of an operational organization and use in our research?



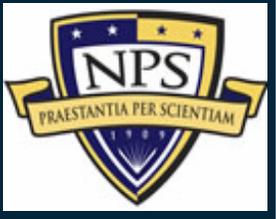


# Introducing the Expeditionary Strike Group (ESG)

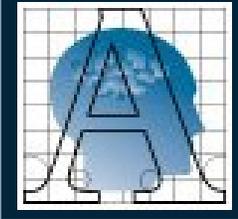


- Personnel
  - ESG FO/GO with a staff of ~50
  - Amphibious Squadron (PHIBRON) Commodore and staff of ~35
  - Marine Expeditionary Unit (Special Operations Capable) Commander and staff of ~150+ and 2000+ marines
  - Ships company for multiple platforms
- Missions:
  - Expeditionary Warfare, MIO, MSO, SUW, USW, MIW, STRIKE, SOF, Air Defense, Disaster Relief/Humanitarian ops...
- Platforms:
  - Amphibious Assault Ship (LHA), Dock Landing Ship (LSD), Amphibious Transport Dock (LPD), Cruiser (CG), Destroyer (DDG), Frigate (FFG), Fast Attack Sub (SSN)

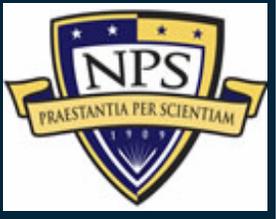




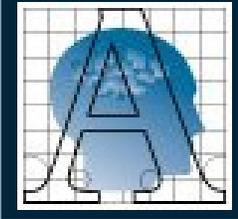
# Our Approach to ESG Engagement



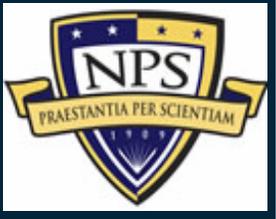
- A. Begin engagement with staff before deployment
- B. Identify organizational challenges of interest
- C. Gain deeper understanding through on-board exposure
  - Interview ESG staff
  - Observe ESG & Ship operations
- D. Compile and distill information
- E. Reassess challenges of interest
- F. Bring challenges to A2C2 experimentation and modeling groups
- G. Work with ESG staff to ensure operational relevance



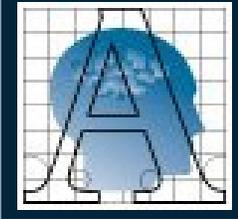
# A. Begin engagement with staff before deployment



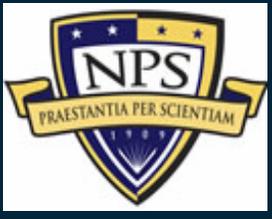
- Small meetings with members of the ESG staff and A2C2 research group
- Attended Commander's Conference for exposure to a larger organization
- Attended workshop and training events
- Additional meetings with members of ESG staff to assess their goals and interests
- Relationship-building to enable access during deployment



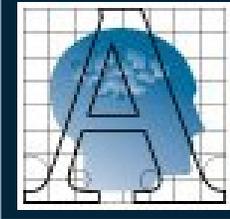
## B. Identify organizational challenges of interest



1. CPR cell: Amphibious Warfare
  2. CPR cell: Maritime Operations
  3. ISR Coordinator
  4. Hybrid Supported-Supporting Structure
  5. EAG Distributed C2
  6. C2 of Temporary Assets
  7. Direct Tasking of MAGTAF Assets (ACE)
  8. TLAM “Ownership”
- } Consolidated into one issue



# C. Gain deeper understanding through on-board exposure

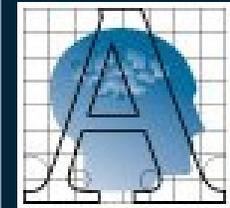


- Two multi-day trips to ESG flagship
- 4-5 scientists per trip
- Trip 1
  - Pre-theatre
  - During multi-national exercise (CENTCOM)
- Trip 2
  - Post-theatre
  - During transit back to CONUS



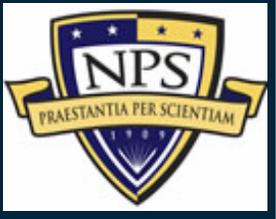


# ESG staff members interviewed

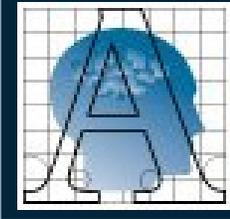


<b>ESG</b>	<b>PHIBRON</b>
Commander, ESG	Commodore
Chief of Staff	Future Operations
N2: Intelligence	Current Operations
N3: Operations	Intelligence
N5: Future Operations	<b>MEU (SOC)</b>
N6: C4I	Commander
Other staff officers, watch standers	Executive Officer
<b>Ship's Company</b>	Intelligence, Operations, Planning, C4I
Ship CO	ACE Commander

Over 40 ESG staff members interviewed

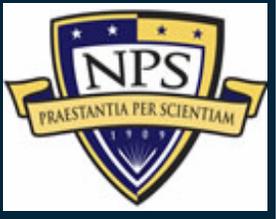


# Where we were observing

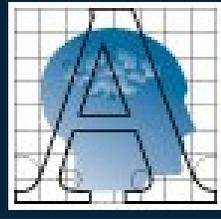


- Joint Operations Center (JOC)
  - Flag Watch Officer
  - Assistant Flag Watch Officers
  - PHIBRON
- Daily Meetings
  - Admiral's Briefing
  - N-Head (Senior Staff) Meeting
  - Composite Warfare Commander Meetings
  - Future and Current Operations Meetings
- Normal Ship Operations

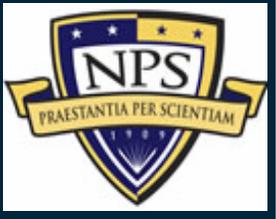




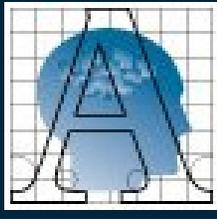
## D. Compile and distill information



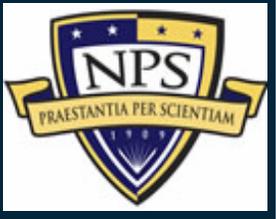
- Notes from observations and interviews consolidated
- Comments relevant to top challenges were pulled out
- Reports were written; presentations were given



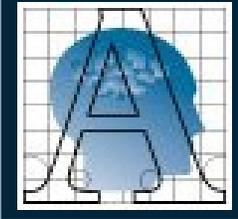
## E. Reassess challenges of interest



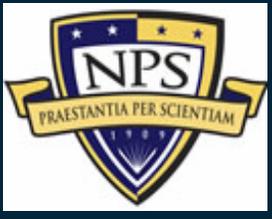
- Each of the “Top Issues” was revisited
- New thoughts based on observations and previous experience in A2C2
- Context within the particular ESG taken into consideration
- Following slides made after first trip to ESG flagship
- Represents interim observations



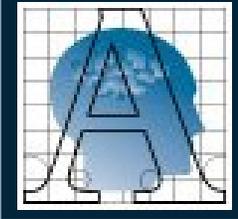
# Issue 1: CPR cell Structure: Amphibious Warfare



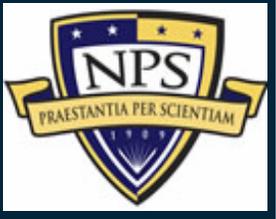
- *Potential issue (observed or assumed)*
  - Overload of CPR and staff
  - Node is operating under two different doctrines
  - Small junior staff
- *What do we need to know/measure*
  - Situations where overload was observed (when, who, ...)
  - Situations where planning or other functions migrated to ESG staff



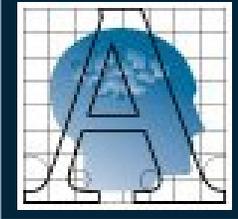
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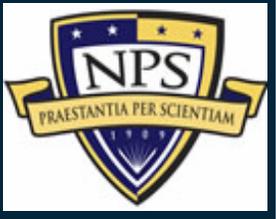
- **BLUF:**
  - *They do not believe it will be an issue during this deployment*
  - *Some staff changes recommended*
- *Potential issue (observed or assumed)*
  - Overload of CPR and staff
    - MIO has been reduced recently, MSO given to DESRON
  - Node is operating under two different doctrines
    - Issue seems to be two different missions more than two different doctrines
  - Small junior staff
    - Staff changes per Navy report recommended
- *What do we need to know/measure*
  - Situations where overload was observed (when, who, ...)
    - None since deploy – Gulf role for MEU uncertain
  - Situations where planning or other functions migrated to ESG staff
    - None since deploy



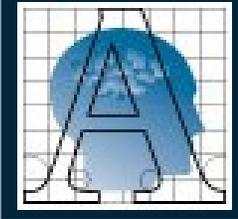
# Issue 2: CPR Cell Structure: Maritime Operations



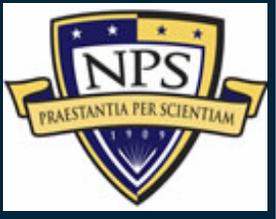
- *Potential issue (observed or assumed)*
  - High expected workload in MIO/MSO
  - MIO differs significantly from other maritime duties
  
- *What do we need to know/measure*
  - Frequency, duration and type of maritime tasks
  - Adequacy of intel to support MIO (e.g., results of VBSS activities)
  
- *Comments*
  - MIO and MSO may be combinable, both use very similar Maritime Picture



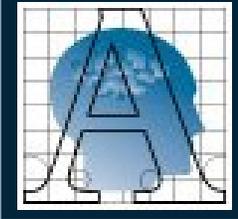
# Issue 2: CPR Cell Structure: Maritime Operations



- **BLUF:**
  - *They do not believe it will be an issue during this deployment*
  - *Some staff changes recommended*
- *Potential issue (observed or assumed)*
  - High expected workload in MIO/MSO
    - MIO has been reduced recently, MSO given to DESRON 50
  - MIO differs significantly from other maritime duties
    - Reality: MIO has been reduced recently
- *What do we need to know/measure*
  - Frequency, duration and type of maritime tasks
    - None since deploy – Gulf role uncertain
  - Adequacy of intel to support MIO (e.g., results of VBSS activities)
    - None since deploy – Gulf role uncertain
- *Comments*
  - MIO and MSO may be combinable, both use very similar Maritime Picture
    - MIO has been reduced recently



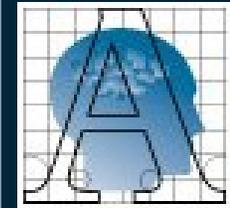
# Issue 3: ISR Coordinator or Commander



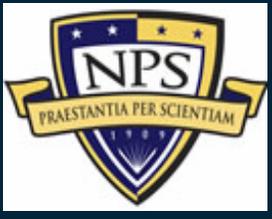
- ***Recommendations***
  - Establish role of ISR commander or coordinator to prioritize asset utilization for ISR
  - Have tasking authority of ISR-dedicated assets (e.g., UAV)
  - Coordinate tasking of other assets for ISR purposes
  - ISR-C must be part of ESG planning cells especially current ops
- ***What do we need to know/measure***
  - What is the evolved ESG N2/S2/JIC organization
  - Process for gathering and prioritizing ISR requests and tasking
  - External ISR support requested and fulfilled
  - ISR tasking of organic ISR assets
  - ISR requirements filled by non-ISR dedicated assets (and process for accomplishing)
  - Assigned role of ESG-N2 with respect to ISR
- ***Comments***
  - The ISR-C could be an augmented role for the ESG N2



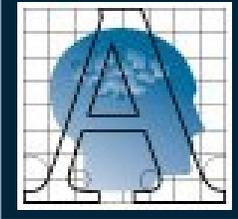
# Issue 3: ISR Coordinator or Commander



- **BLUF: N2 as ISR Coordinator seemed OK, BUT “best” answer unknown**
- **Recommendations**
  - Establish role of ISR commander or coordinator to prioritize asset utilization for ISR
    - Partially done
  - Have tasking authority of ISR-dedicated assets (e.g., UAV)
    - Not done explicitly - recommends
  - Coordinate tasking of other assets for ISR purposes
    - Only indirectly, if at all (COPS/FOPS)
  - ISR-C must be part of ESG planning cells especially current ops
    - Done, but as N2
- **What do we need to know/measure**
  - What is the evolved ESG N2/S2/JIC organization
  - Process for gathering and prioritizing ISR requests and tasking
  - External ISR support requested and fulfilled – **tend to use UAV instead**
  - ISR tasking of organic ISR assets
  - ISR requirements filled by non-ISR dedicated assets (and process for accomplishing)
  - Assigned role of ESG-N2 with respect to ISR
- **Comments**
  - The ISR-C could be an augmented role for the ESG N2.
    - (It is.) Mission uncertainty/disagreement and overall ESG C2 philosophy issues affect
    - Emphasis seems to be more on meeting ISR requirements than exploiting all possible ISR opportunities



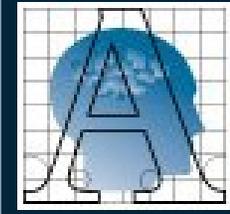
# Issue 4: Hybrid Supporting-Supported Structure and Internal Control



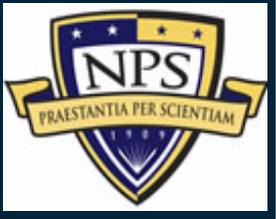
- **Potential issue (observed or assumed)**
  - Unknown when S-S breaks down
  - Managing a spectrum of S-S relations: from preset to fully dynamic/contingent.
  - Supported commander needs sufficient staff to plan and guide the mission.
- **Recommendations**
  - Be prepared to augment planning capability/staff of a supported Cdr.
  - Current ops must be ready to resolve conflicts that may arise
  - Supported/supporting assignments should consider other factors
- **What do we need to know/measure**
  - ESG's guidelines and implementation for S-S relationships
  - Situations - single Cdr simultaneously supported multiple Cdrs (who, what, how,...)
  - Situations - single Cdr simultaneously supported and supporting (who, what, how,...)
  - Conflicts and how they were resolved



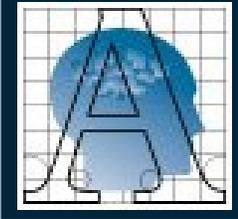
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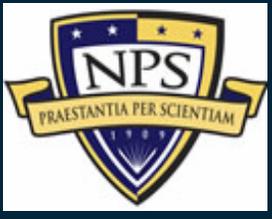
- ***BLUF: Not an issue so far, but not stressed yet. Also, Navy-Marine MOU\*.***
  - ***Potential issue (observed or assumed)***
    - Unknown when S-S breaks down
      - Little stress so far
    - Managing a spectrum of S-S relations: from preset to fully dynamic/contingent.
      - Little stress so far
    - Supported commander needs sufficient staff to plan and guide the mission.
      - Can request and get specific skills from N5
  - ***Recommendations***
    - Be prepared to augment planning capability/staff of a supported Cdr.
      - Done somewhat (N5-see above)
    - Current ops must be ready to resolve conflicts that may arise
    - Supported/supporting assignments should consider other factors
  - ***What do we need to know/measure***
    - ESG's guidelines and implementation for S-S relationships
    - Situations - single Cdr simultaneously supported multiple Cdrs (who, what, how,...)
      - None since deploy
    - Situations - single Cdr simultaneously supported and supporting (who, what, how,...)
      - None since deploy
    - Conflicts and how they were resolved
      - None since deploy
- \* train under a FO (CWC); deploy under S-S



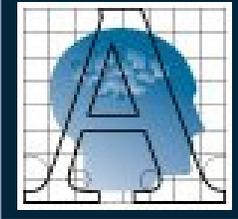
# F. Bring challenges to A2C2 experimentation and modeling



- Need to bring challenges back into the laboratory
- Motivated by – but not fully constrained by – current and planned ESG
- Inspired by original “Top Issues”
  - ISR Coordinator
  - Supporting/Supported
  - Phibron Composition
- Must retain operational relevance **and** still be general
- One chosen Independent Variable...so far
  1. Information Commander/Coordinator



# Independent Variable: Information Commander



- Related to ISR Coordinator Issue
- Motivated in part by ESG experience with N2 (Intelligence)
- Connected to previous A2C2 research
  - NWC & SSG work
- Multiple levels of **Information Commander** authority and responsibility
- Two or three levels of this variable
- Simplified continuum compressed to one dimension
- We need to be cognizant of – but not constrained by – the “real-world” implications of our design choices

None

Coordination

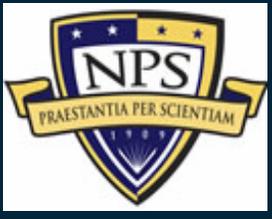
Control



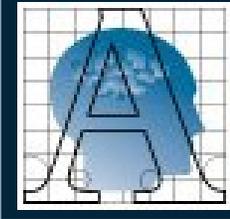
No Info Coordinator

Info Coordinator with  
control over some assets  
and some information

Info Commander w/  
control over all assets  
and information



# Possible ESG Experimental Positions



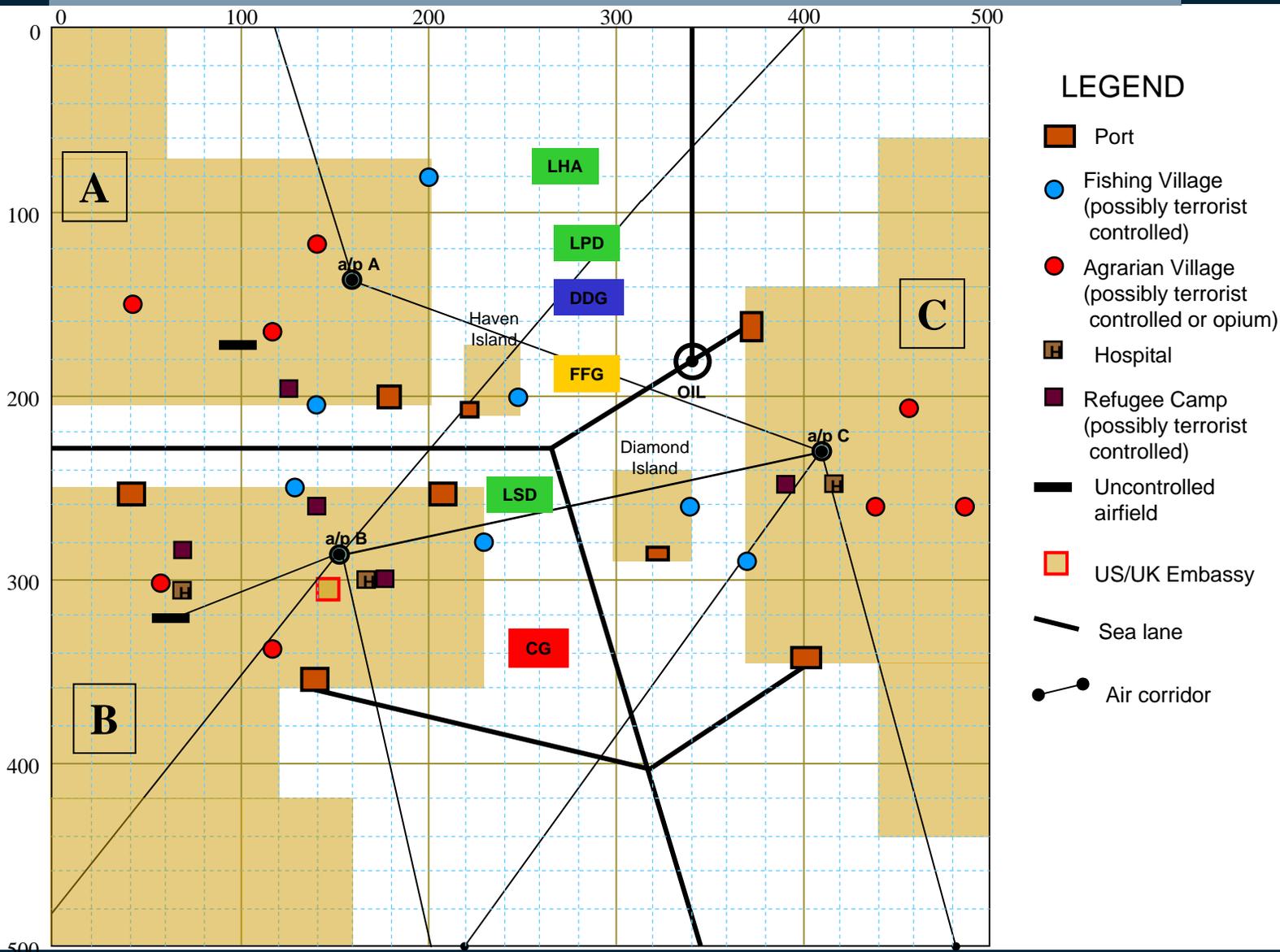
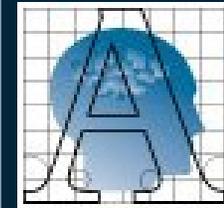
- Simplification of ESG for DDD simulation
- No FO/GO
- Commodore and MEU Commander responsibilities distributed into two positions

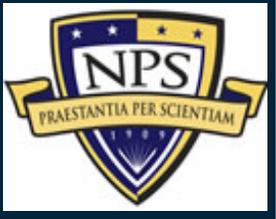
Focus for next experiment

		Role
DDD Position	<b>ESG<sub>1</sub></b>	CAT Leader and Plans
	<b>ESG<sub>2</sub></b>	Current Ops Info Commander/Coordinator
	<b>CPR<sub>1</sub></b>	Current Ops
	<b>CPR<sub>2</sub></b>	CAT and Plans
	<b>MEU<sub>1</sub></b>	Current Ops
	<b>MEU<sub>2</sub></b>	CAT and Plans

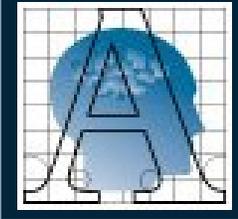


# DDD Scenario Development

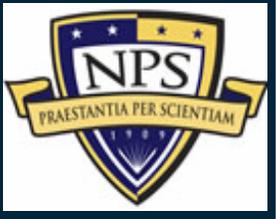




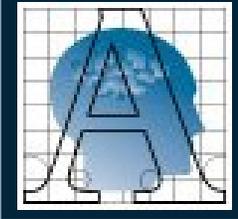
# Possible Dependent Variables



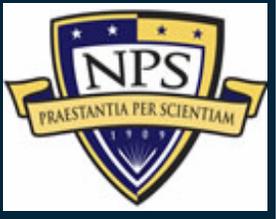
- Resource allocation
  - ISR
  - Non-ISR
- DDD Performance
- Information access
  - Time
  - # Number of hits
- Communications Patterns
  - Within vs between groups communications
- Coordination Efficiency
- Subjective Workload/Attitudes
- Eyetracking
  - Pupil dilation
  - Gaze
- Information presentation
  - Use of collaborative tools
  - Page Views
  - Time/info match
- Planning inquiries
  - Process tracing
  - Collaboration Assessment via Probes
- Post-hoc Computational Measures



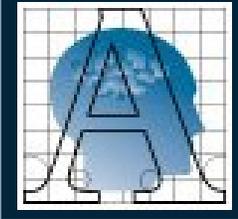
## G. Work with ESG staff to ensure operational relevance



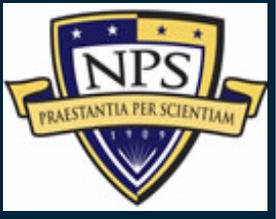
- Presented expanded experimental design ideas
- Operational perspective on experimentation is very informative
  - Issues of interest in the literature may not be most critical to the warfighter
- Need to balance specificity and generality
- Interaction with ESG staff is ongoing
- Interaction with other ESGs TBD



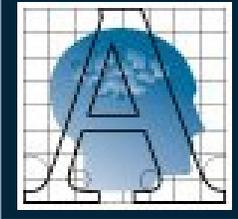
# Next steps



- Experimental variables to be settled based on recent feedback from ESG staff
- Scenario being designed at the Naval Postgraduate School
- Inclusion of collaboration tools, intelligent agents, and complementary modeling being assessed
  - Joint efforts with CMD21 research program
- Pilot scheduled for Fall 06
- Full experiment scheduled for Winter 2007

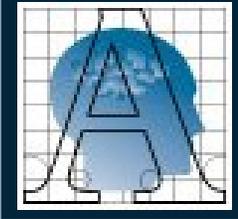
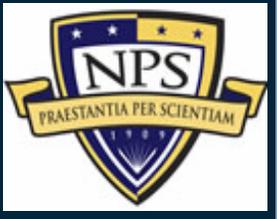


# Some lessons learned



- Goal is to bridge the gap between research and operational concerns
- Difficult to compare apples with apples
  - Is SA in the lab the same as SA in a real-world ESG?
- Issues that are fair game in the laboratory can be insulting or politically sensitive in the operational org
  - How would I study “Unity of Command” without implying that it was a problem?\*
- Some issues depend on organization size and pace
- When we consider modeling an organization, need to decide which aspects of the real ESGs to emulate

\* It wasn't a problem



Thank You

# EXPEDITIONARY STRIKE GROUP

## 22d Marine Expeditionary Unit



Command Element



Battalion Landing Team  
1st Battalion, 2d Marines



Marine Medium Helicopter Squadron 162  
(Reinforced)



MEU Service Support Group 22

## Amphibious Squadron Eight



USS Saipan (LHA-2)



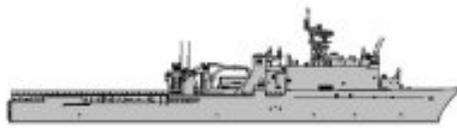
USS Philippine Sea (CG-58)



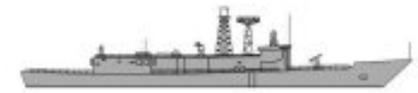
USS Ponce (LPD-15)



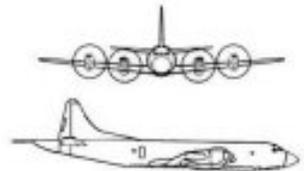
USS Gonzalez (DDG-66)



USS Gunston Hall (LSD-44)



USS Nicholas (FFG-47)



P3C Orion



USS Miami (SSN-775)





ADAN MCNEESE

ADAM TARUM  
13

BEACH  
FIELD